



AMSR2 Products Update

Japan Aerospace Exploration Agency
Earth Observation Research Center

March 1, 2017



Update overview

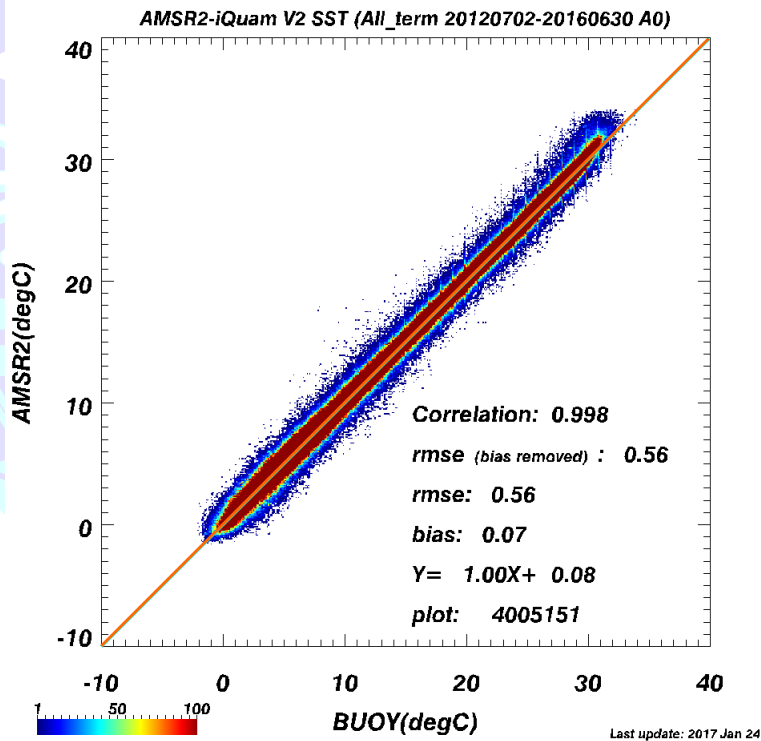
- As for standard products,
 - Sea surface temperature (SST)
 - Sea surface windspeed (SSW)
 - Sea ice concentration (SIC)
 - Soil moisture content (SMC)were updated to version 3.
- As for research products,
 - 10-GHz SSTwas updated.

1. (Standard) SST

- **Principal Investigator**
 - Akira Shibata (Remote Sensing Technology Center of Japan)
- **Update / Improvement Highlights**
 - **Filtering of poor-quality buoy data for validation**
 - **Improvement of C-band RFI (Radio Frequency Interference) detection method around Japan**
 - Improvement of the land-ocean flag
- **Validation Method**
 - Comparison with In-situ SST data obtained by buoys
 - The retrieval accuracy is estimated by root-mean-square-error (RMSE).
- **Validation Data and Match-up Condition**
 - Matched-up AMSR2 and buoy SST within 2 hours (temporally) and 30 km (spatially).
 - Buoy data is included in NOAA's iQuam dataset, and its quality is verified in advance.
- **Validation Period**
 - from July 2, 2012 to June 30, 2016

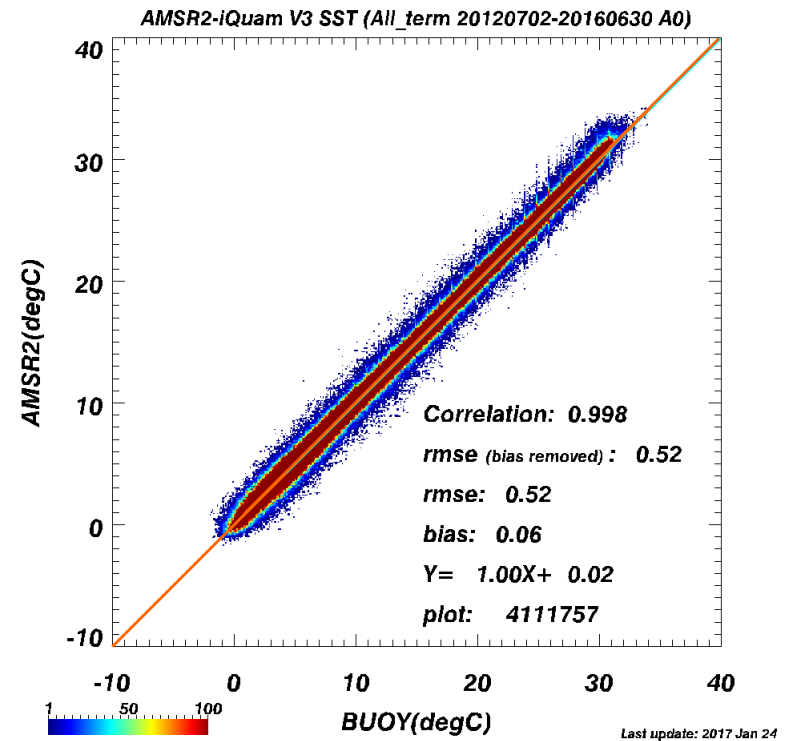
1. (Standard) SST

V2(Asc.)



V2 (Asc.)	
RMSE	0.56 °C
Bias	0.07 °C

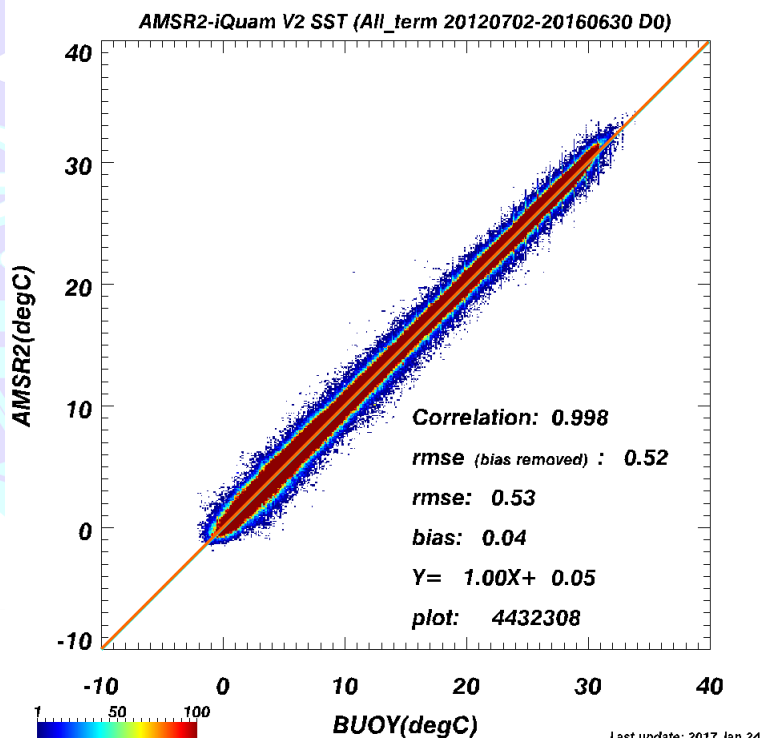
V3(Asc.)



V3 (Asc.)	
RMSE	0.52 °C
Bias	0.06 °C

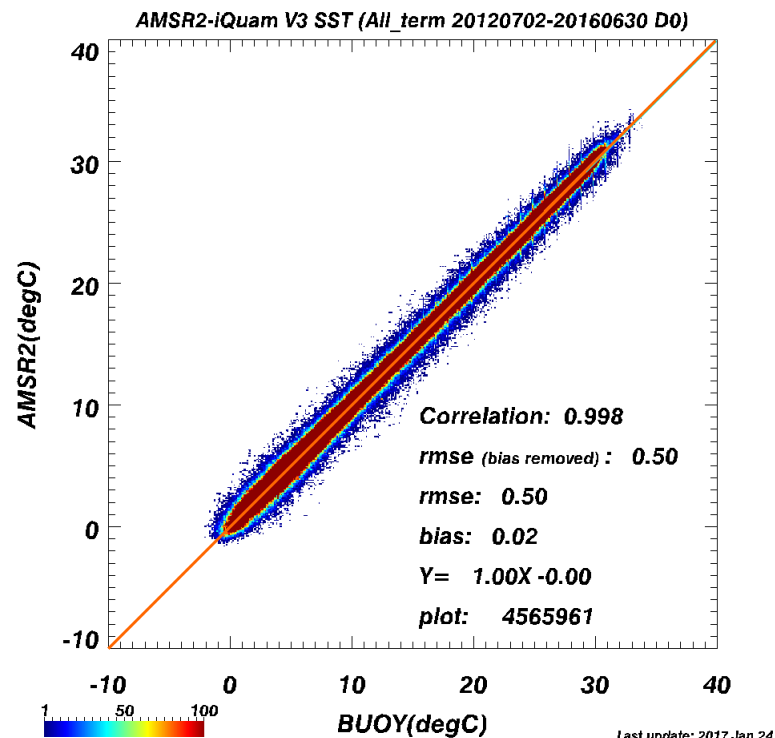
1. (Standard) SST

V2(Dsc.)



V2 (Dsc.)	
RMSE	0.53 °C
Bias	0.04 °C

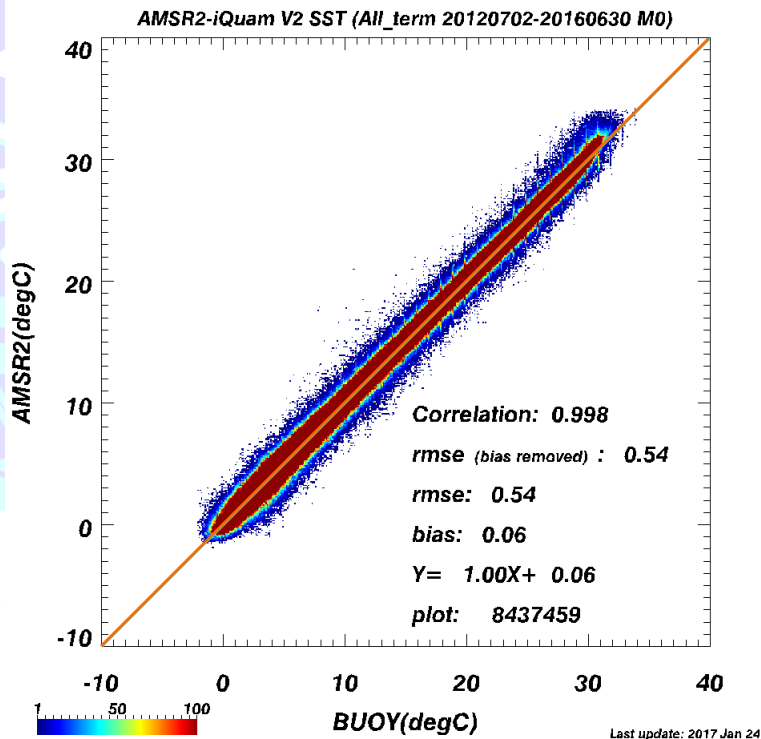
V3(Dsc.)



V3 (Dsc.)	
RMSE	0.50 °C
Bias	0.02 °C

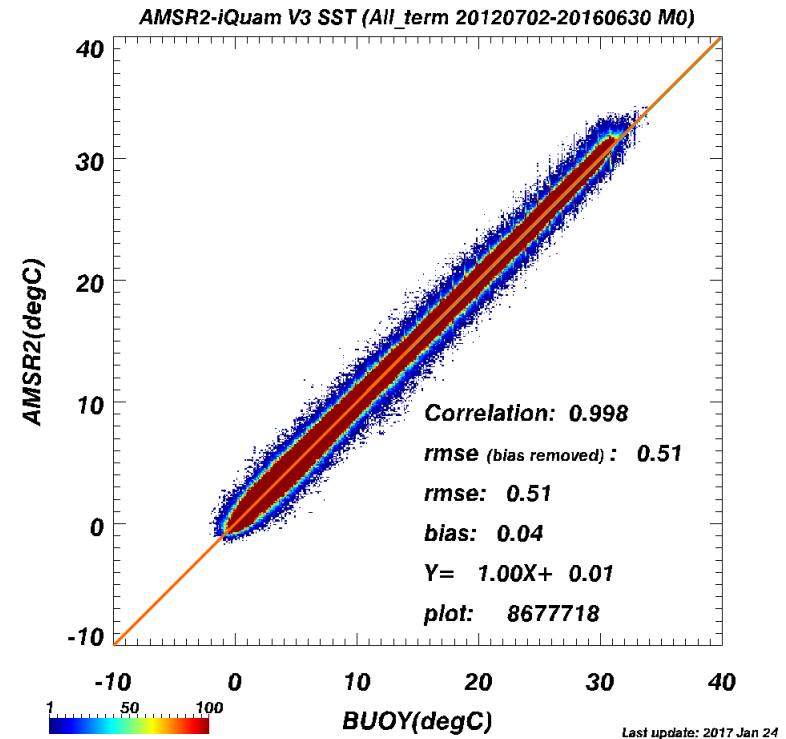
1. (Standard) SST

V2(Asc.+Dsc.)



V2 (Asc. + Dsc.)	
RMSE	0.54 °C
Bias	0.06 °C

V3(Asc.+Dsc.)



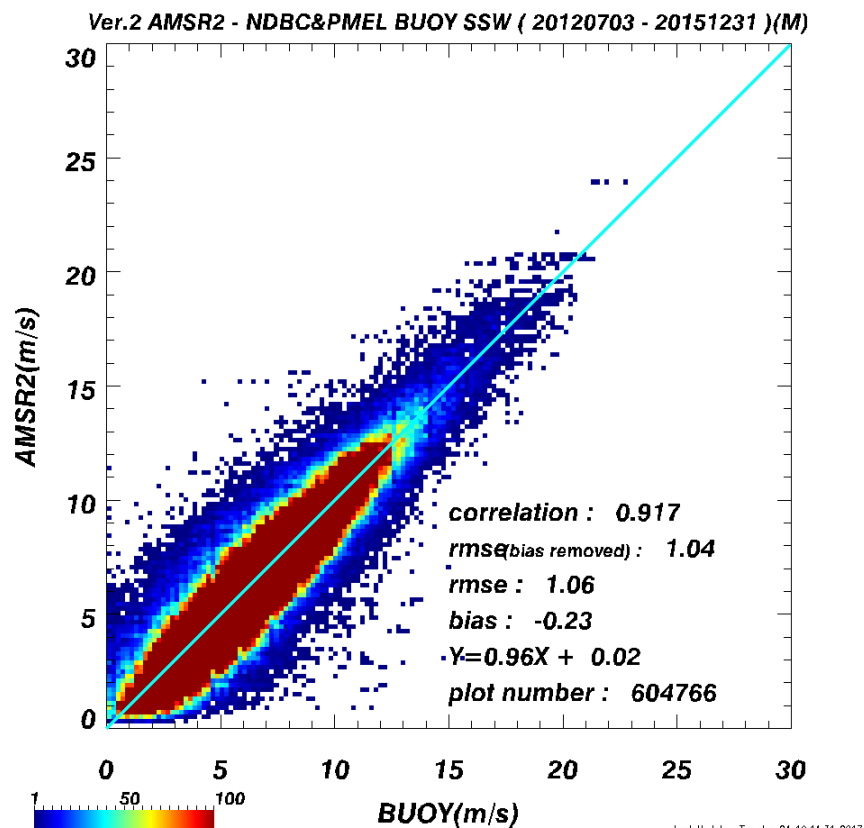
V3 (Asc. + Dsc.)	
RMSE	0.51 °C
Bias	0.04 °C

2. (Standard) SSW

- **Principal Investigator**
 - Akira Shibata (Remote Sensing Technology Center of Japan)
- **Update / Improvement Highlights**
 - **Improvement of brightness temperature correction for air temperature at sea level**
 - Improvement of the land-ocean flag
- **Validation Method**
 - Comparison with in-situ SSW data obtained by buoys
 - The retrieval accuracy is estimated by root-mean-square-error (RMSE).
- **Validation Data and Match-up Condition**
 - Matched-up AMSR2 and buoy SSW within 2 hours (temporally) and 30 km (spatially).
 - Buoy SSW data is obtained from National Data Buoy Center and NOAA, PMEL ftp site.
- **Validation Period**
 - from July 2, 2012 to December 31, 2015

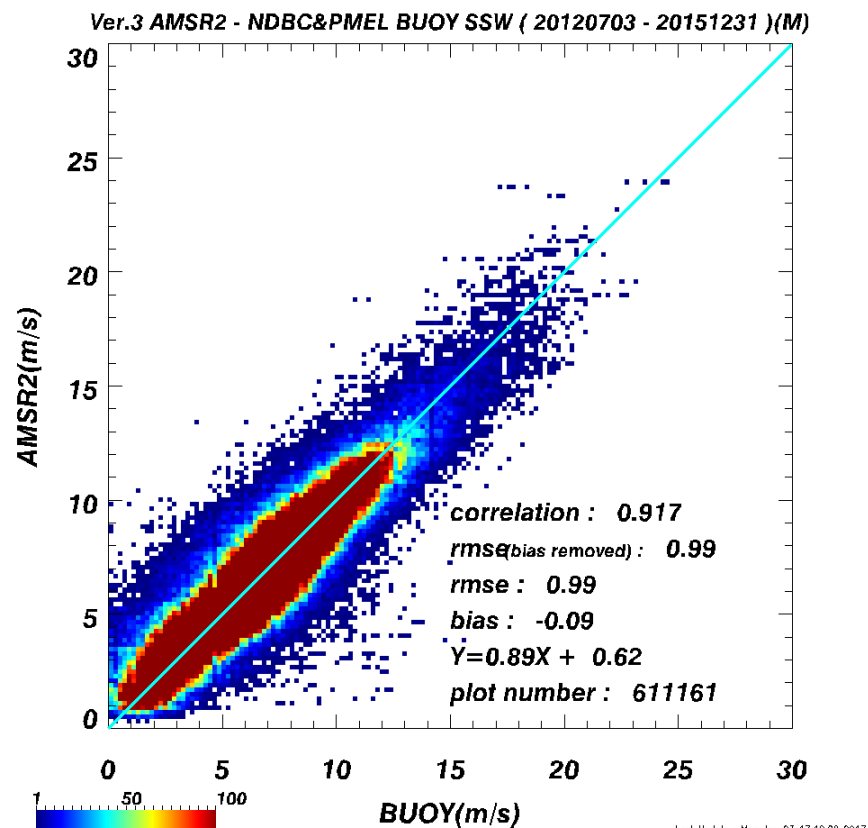
2. (Standard) SSW

V2(Asc.+Dsc.)



V2 (Asc. + Dsc.)	
RMSE	1.06 m/s
Bias	-0.23 m/s

V3(Asc.+Dsc.)



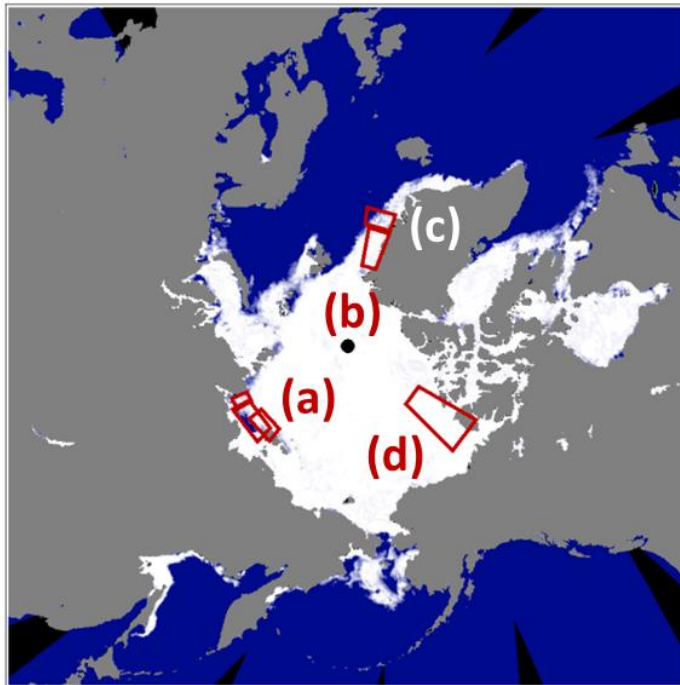
V3 (Asc. + Dsc.)	
RMSE	0.99 m/s
Bias	-0.09 m/s

3. (Standard) SIC

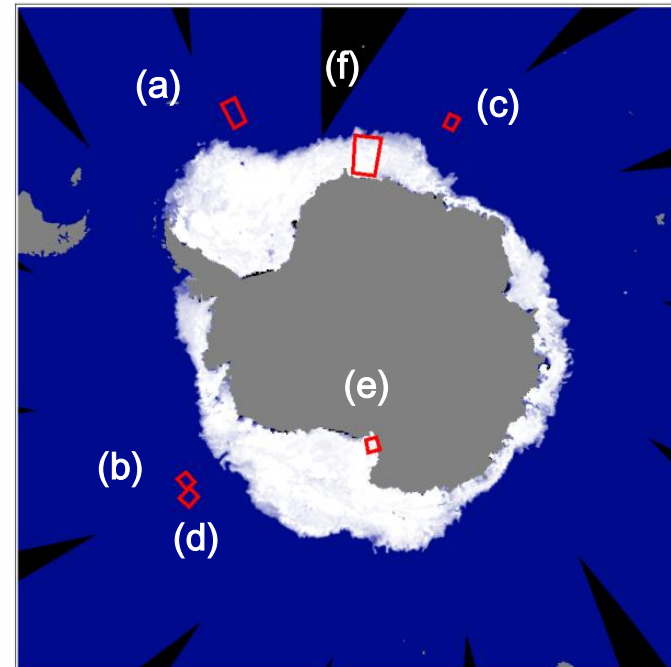
- Principal Investigators
 - Josefino Comiso (NASA/GSFC)
 - Kohei Cho (Tokai Univ.)
- Update/Improvement Highlights
 - **Dynamic update of brightness temperature database corresponding to the open water in the Arctic Sea**
- Validation Method
 - Comparison with SIC retrieved by the reflectance data of MODIS BAND1 (620nm-670nm), BAND3 (459nm-479nm) and BAND4 (545nm-565nm)
 - The retrieval accuracy is estimated by root-mean-square-error (RMSE) in the specific areas and periods with clear sky (see the next slide).

3. (Standard) SIC

Specific areas and periods used for SIC validation



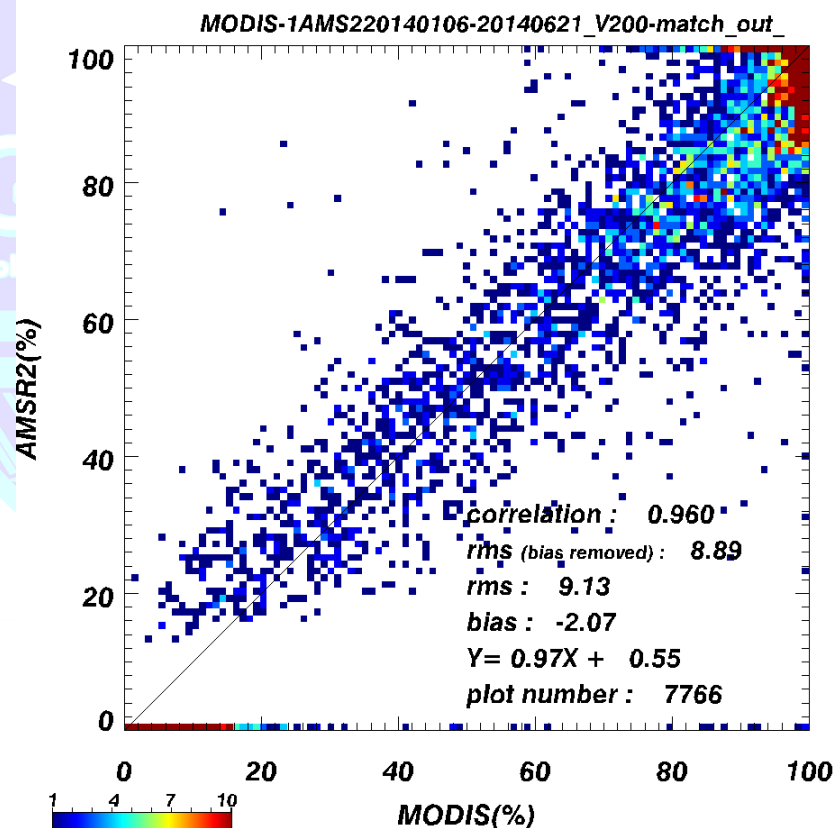
(a) 2014.5.22 - 24	(c) 2014.6.14
(b) 2014.6.10	(d) 2014.6.21



(a) 2013.8.6	(d) 2013.8.16
(b) 2013.8.14	(e) 2013.11.1
(c) 2013.8.15	(f) 2014.3.30

3. (Standard) SIC

V2

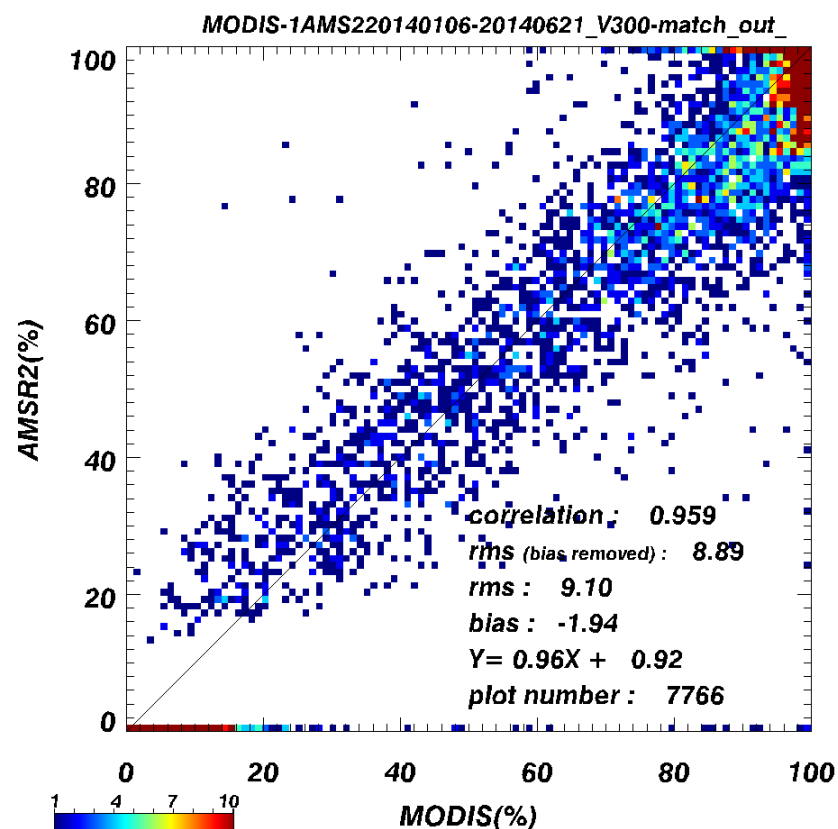


V2

RMSE

9.13 %

V3



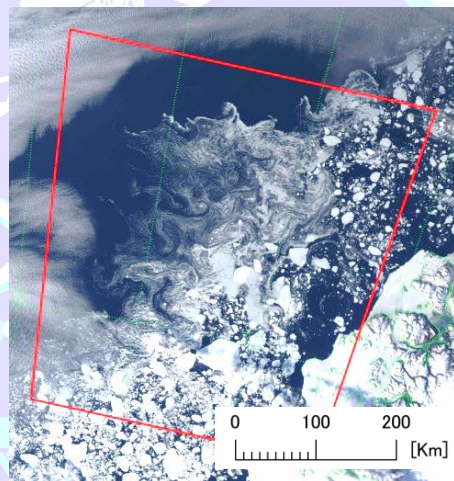
V3

RMSE

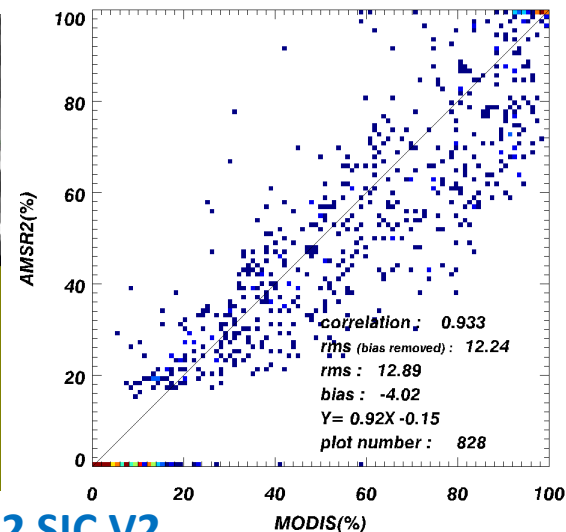
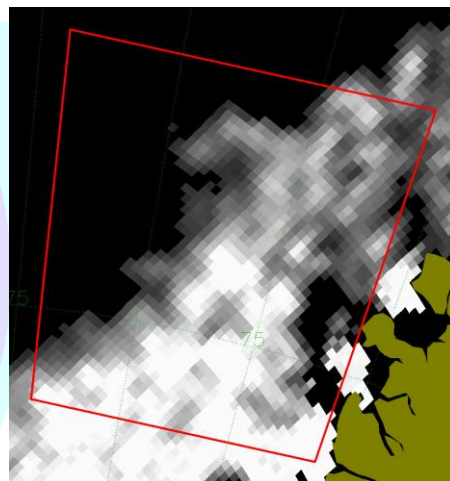
9.10 %

3. (Standard) SIC

MODIS RGB

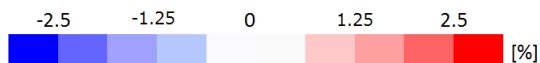
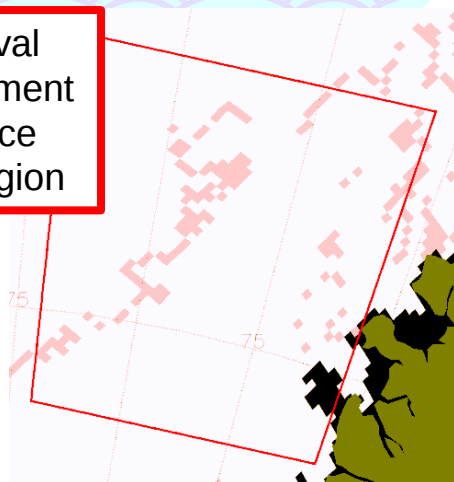


AMSR2 SIC V3

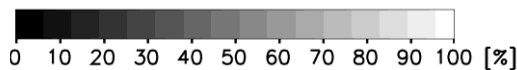
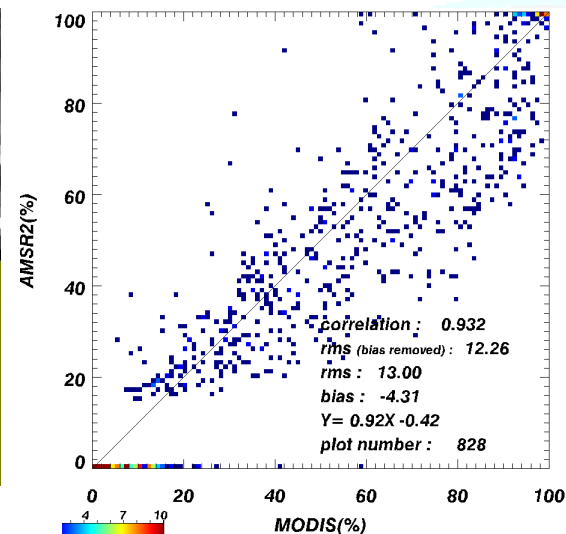
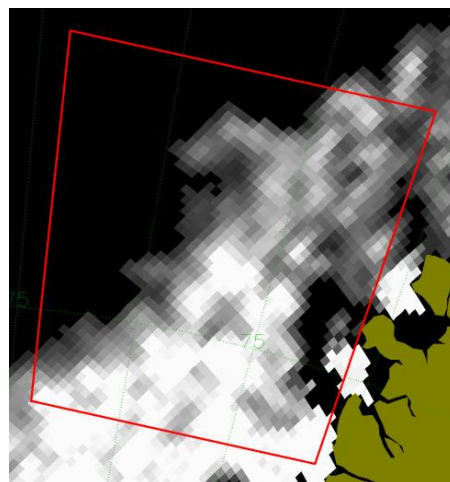


V3 - V2

Retrieval improvement at an ice edge region



AMSR2 SIC V2



4. (Standard) SMC

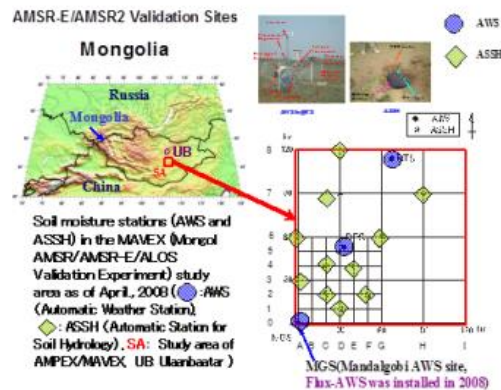
- Principal Investigator
 - Toshio Koike (Univ. of Tokyo)
- Update / Improvement Highlights
 - **Filtering of poor-quality ground observation data in Mongolia**
 - **Improvement of the permittivity model of the dry soil**
- Validation Data
 - In-situ SMC data in Australia, Mongolia and Thailand (see the next slide)
- Validation Method
 - Comparison with in-situ SMC data in the validation sites
 - The retrieval accuracy was estimated by MAE (mean absolute error) between AMSR2 SMC and in-situ SMC.

4. (Standard) SMC

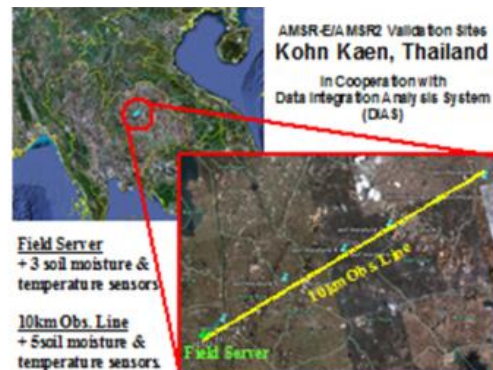
Specific areas and periods used for SMC validation

- Mongolia: Jul. 2012 - Aug. 2016
- Australia: Jul. 2012 - Feb. 2016
- Thailand: Jul. 2012 - Oct. 2012

Mongolia



Thailand



Australia



4. (Standard) SMC

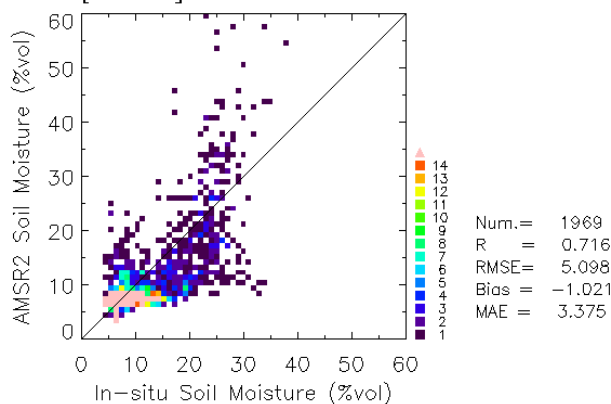
Validation results (V2)

including ground observation data with precipitation

Validation over ALL sites (AUST+MONG+THAI)

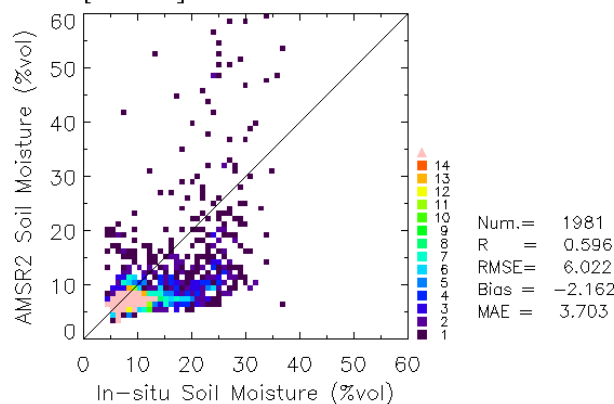
Asc.

[All sites] Jul.2012-Jan.2016 : Asc.



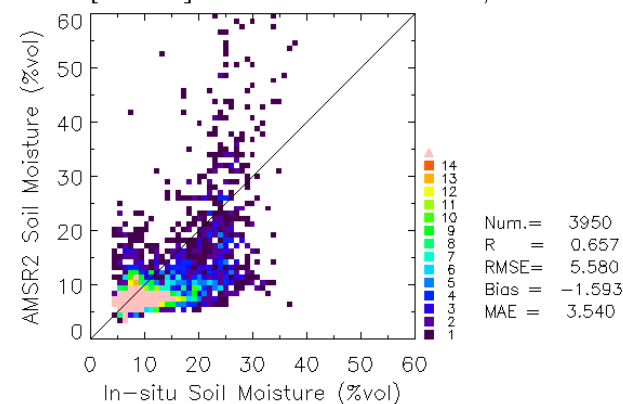
Dsc.

[All sites] Jul.2012-Jan.2016 : Des.



Asc. + Dsc.

[All sites] Jul.2012-Jan.2016 : Des./Asc.



Validation Results

[All sites] Jul.2012-Jan.2016

	Num.	R	RMSE [%]	Bias [%]	MAE [%]
Des.	1981	0.596	6.022	-2.162	3.703
Asc.	1969	0.716	5.098	-1.021	3.375
Des./Asc.	3950	0.657	5.580	-1.593	3.540

V2 (Asc. + Dsc.)

MAE

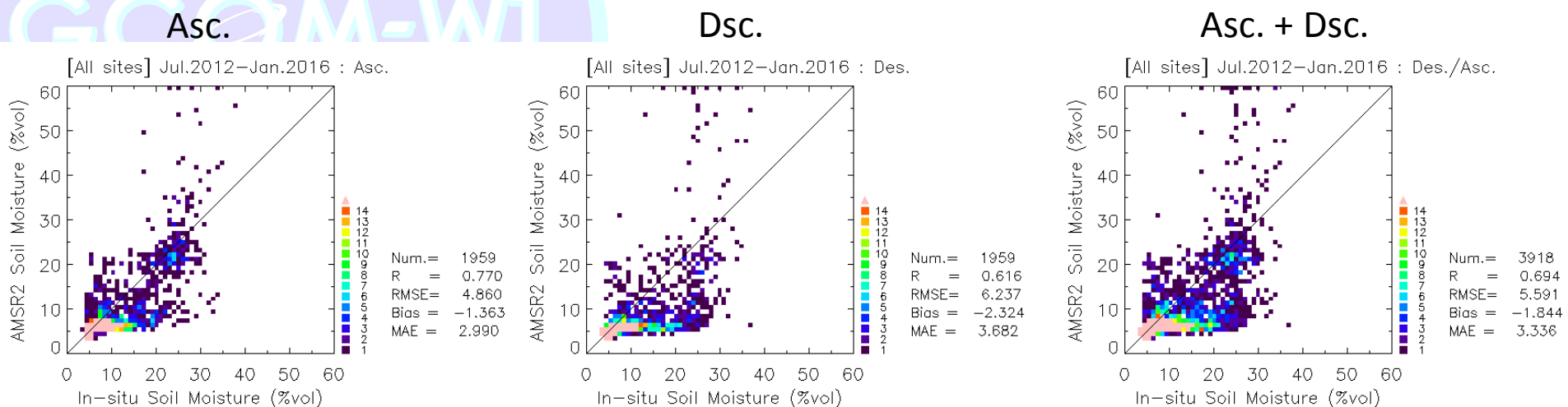
3.54 %

4. (Standard) SMC

Validation results (V3)

including ground observation data with precipitation

Validation over ALL sites (AUST+MONG+THAI)



Validation Results

[All sites] Jul.2012-Jan.2016

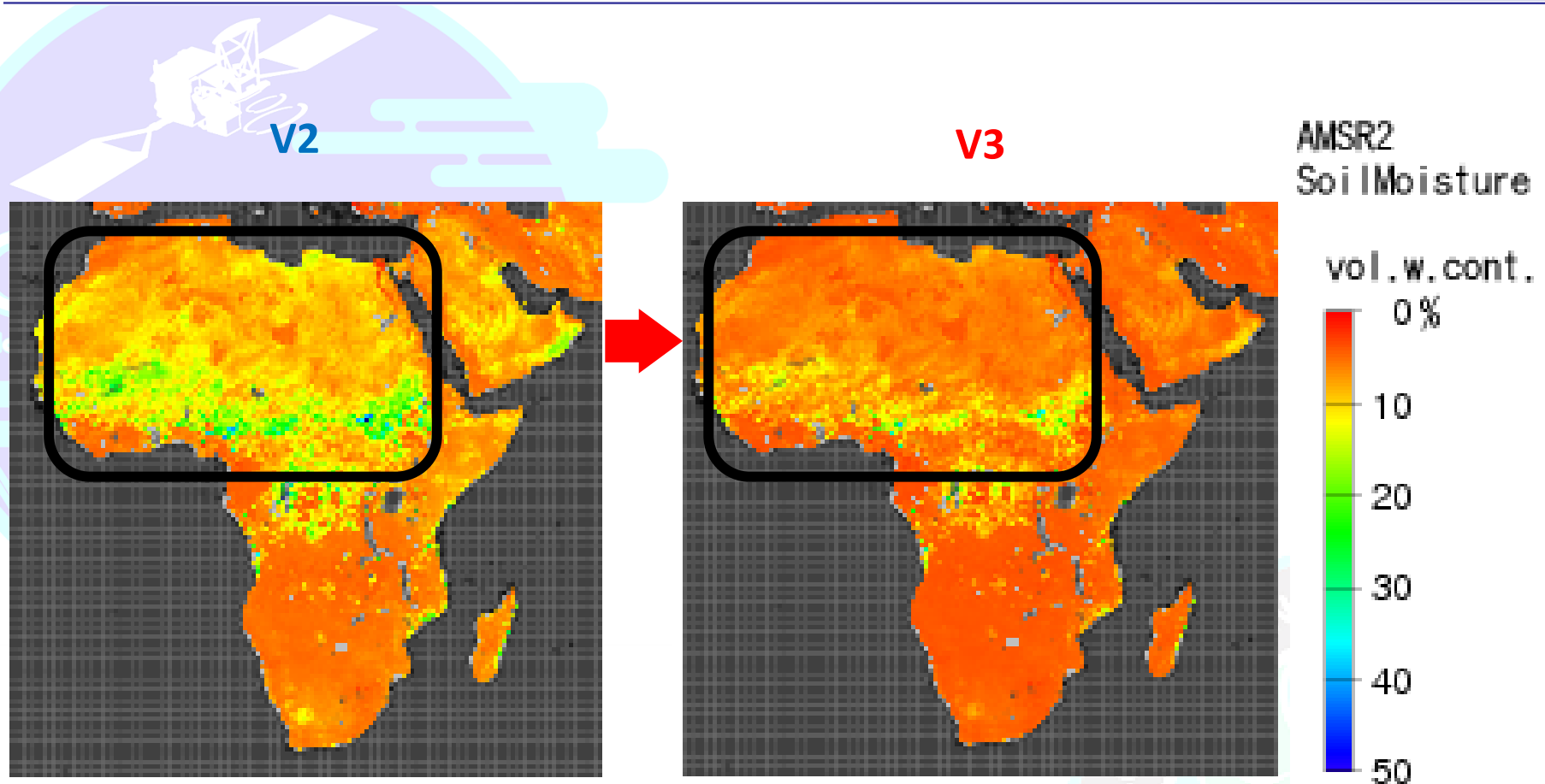
	Num.	R	RMSE [%]	Bias [%]	MAE [%]
Des.	1959	0.616	6.237	-2.324	3.682
Asc.	1959	0.770	4.860	-1.363	2.990
Des./Asc.	3918	0.694	5.591	-1.844	3.336

V3 (Asc. + Dsc.)

MAE

3.34 %

4. (Standard) SMC



Improvement of the soil moisture retrieved in a desert

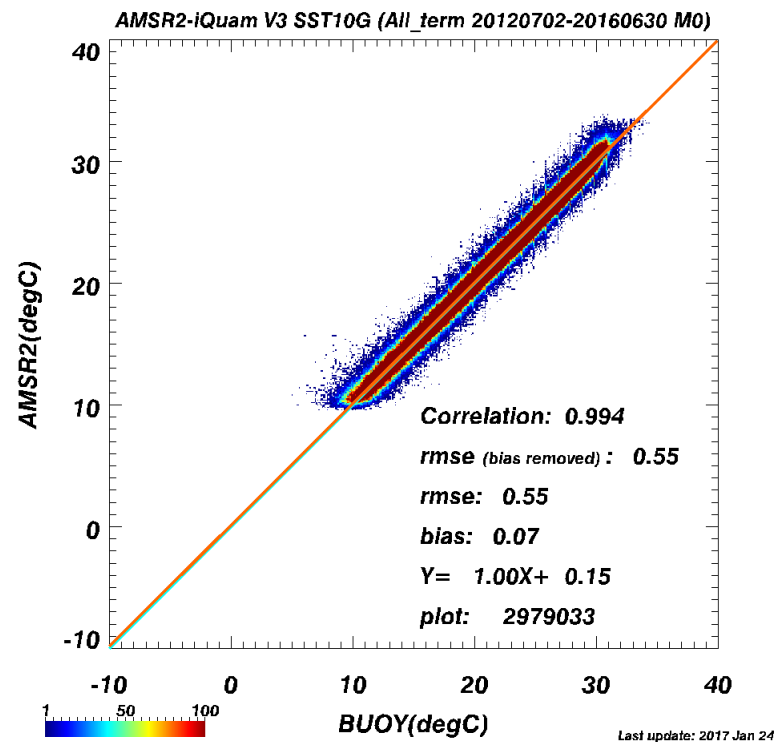
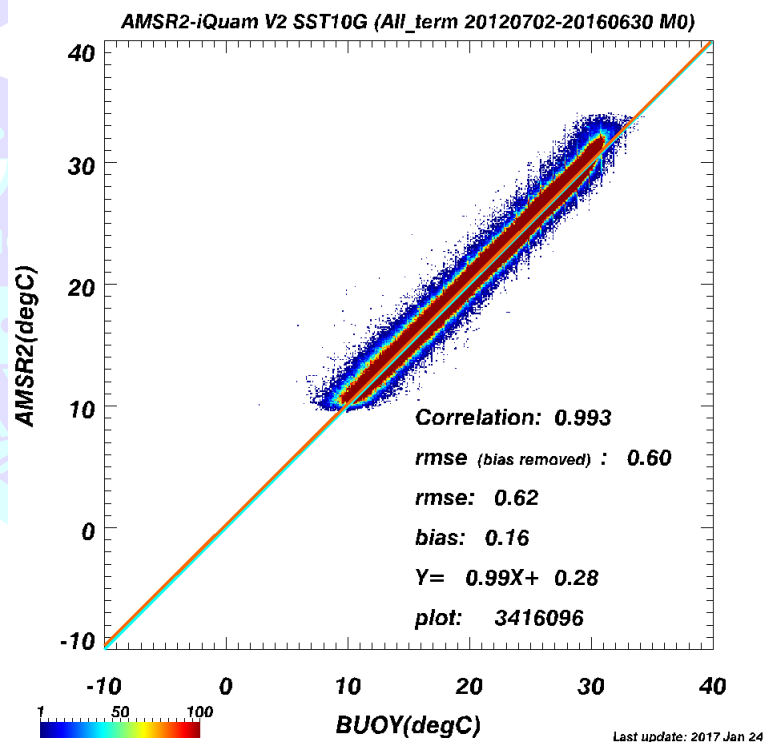
5. (Research) 10-GHz SST

- Principal Investigator
 - Akira Shibata (Remote Sensing Technology Center of Japan)
- Update / Improvement Highlights
 - **Filtering of poor-quality buoy data for validation**
 - **Removal of seasonal bias fluctuations**
 - Improvement of the land-ocean flag
- Validation Method
 - Similarly as the standard SST.
- Validation Data and Match-up Condition
 - Similarly as the standard SST.
- Validation Period
 - from July 2, 2012 to June 30, 2016.

5. (Research) 10-GHz SST

V2(Asc.+Dsc.)

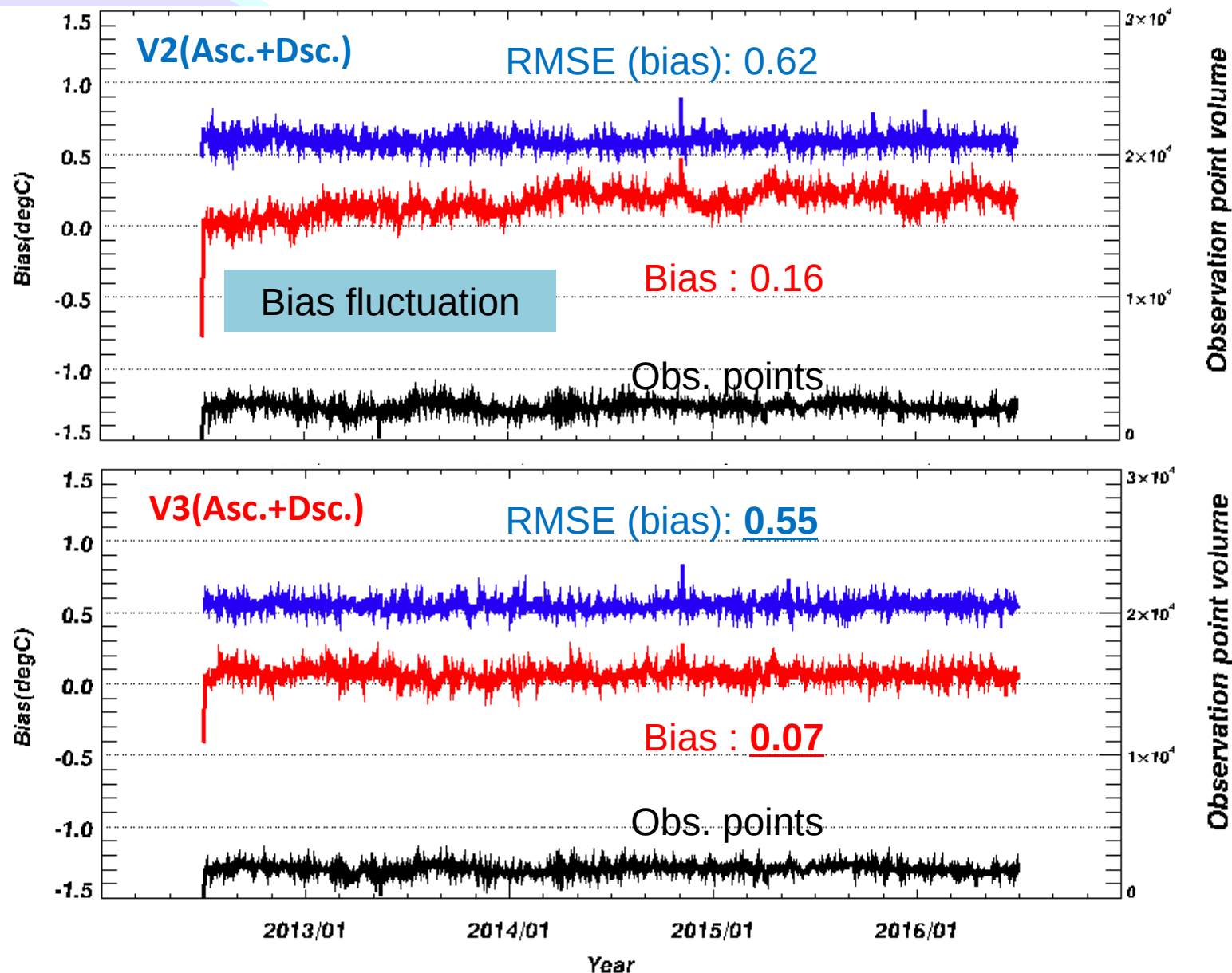
V3(Asc.+Dsc.)



V2 (Asc. + Dsc.)	
RMSE	0.62 °C
Bias	0.16 °C

V3 (Asc. + Dsc.)	
RMSE °C	0.55 °C
Bias °C	0.07 °C

5. (Research) 10-GHz SST



Standard Products

Product	Release Accuracy	Standard Accuracy	Target Accuracy	Current Accuracy
Total Precipitable Water (V2)	$\pm 3.5 \text{ kg/m}^2$	$\pm 3.5 \text{ kg/m}^2$	$\pm 2.0 \text{ kg/m}^2$	RAOB: $\pm 2.5 \text{ kg/m}^2$ GPS: $\pm 1.5 \text{ kg/m}^2$
Cloud Liquid Water (V2)	$\pm 0.10 \text{ kg/m}^2$	$\pm 0.05 \text{ kg/m}^2$	$\pm 0.02 \text{ kg/m}^2$	$\pm 0.04 \text{ kg/m}^2$
Precipitation (V2)	Ocean $\pm 50 \%$ Land $\pm 120 \%$	Ocean $\pm 50 \%$ Land $\pm 120 \%$	Ocean $\pm 20 \%$ Land $\pm 80 \%$	Ocean $\pm 48 \%$ Land $\pm 86 \%$
Sea Surface Temperature (V3)	$\pm 0.8 \text{ }^\circ\text{C}$	$\pm 0.5 \text{ }^\circ\text{C}$	$\pm 0.2 \text{ }^\circ\text{C}$ (as zonal mean)	Asc. $\pm 0.5 \text{ }^\circ\text{C}$ Dsc. $\pm 0.5 \text{ }^\circ\text{C}$
Sea Surface Wind Speed (V3)	$\pm 1.5 \text{ m/s}$	$\pm 1.0 \text{ m/s}$	$\pm 1.0 \text{ m/s}$	$\pm 1.0 \text{ m/s}$
Sea Ice Concentration (V3)	$\pm 10 \%$	$\pm 10 \%$	$\pm 5\%$	$\pm 9.07 \%$
Soil Moisture Content (V3)	$\pm 10 \%$	$\pm 10 \%$	$\pm 5 \%$	$\pm 3.3 \%$
Snow Depth (V2)	$\pm 20 \text{ cm}$	$\pm 20 \text{ cm}$	$\pm 10 \text{ cm}$	$\pm 17.7 \text{ cm}$

Not Achieved Standard Accuracy	Achieved Standard Accuracy	Achieved Target Accuracy
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Updated

Research Products

Updated

Product	Target Accuracy	Range	Current Accuracy
All-weather Sea Surface Windspeed (ASW)	± 7 m/s	0 - 70 m/s	± 4.18 m/s
10-GHz SST	± 0.8 °C	9 - 35 °C	0.55 °C
Land Surface Temperature (LST)	Forest : ± 3 °C Low vegetation : ± 4 °C	0 - 50 °C	Now validating
Vegetation Water Content (VWC)	± 1 kg/m ²	0 - 4 kg/m ²	Now validating
High-resolution Sea Ice Concentration (ASI)	± 15 %	0 - 100 %	Now validating
Detection of Thin Sea Ice (TSI)	80 % (as right answer rate)	N/A	Now validating
Sea Ice Motion (SIM)	± 3 cm/s (in NS and EW components)	0 - 40 cm/s	Now validating
SMC and VWC by Land Assimilation Model	SMC : ± 8 % VWC : ± 1 kg/m ²	0 - 100 % 0 - 2 kg/m ²	Now implementing